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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/624,420	07/22/2003	Michael Friedemann	2000.108100	7246
23720	7590	03/31/2005	EXAMINER	
WILLIAMS, MORGAN & AMERSON, P.C. 10333 RICHMOND, SUITE 1100 HOUSTON, TX 77042			VERSTEEG, STEVEN H	
			ART UNIT	PAPER NUMBER
			1753	

DATE MAILED: 03/31/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/624,420	Applicant(s) FRIEDEMANN ET AL.	
	Examiner Steven H VerSteeg	Art Unit 1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 May 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-14 and 16-23 is/are rejected.
- 7) ☒ Claim(s) 15 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 July 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>5/17/04</u> . | 6) <input type="checkbox"/> Other: _____ |

2e

DETAILED ACTION

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: **114** (see Figure 1b). Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-13, and 17-23 are rejected under 35 U.S.C. 102(e) as being anticipated by US 2004/0134769 A1 to Wang et al. (Wang).

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4. For claim 1, Applicant requires a method comprising depositing a first layer of conductive material onto a substrate having forming therein an opening in a sputter deposition atmosphere having a first state with a pressure of a first value and a bias power of a first value for accelerating target ions towards the substrate; establishing a second state for said sputter deposition atmosphere by increasing at least one of said bias power and said pressure to a second value; and depositing a second layer of conductive material in said sputter deposition atmosphere, said sputter deposition atmosphere being in said second state.

5. For claim 17, Applicant requires a method comprising forming by sputter deposition, a conductive material layer over an interconnected opening formed on a substrate, wherein a bias power for enhancing a directionality of deposition particles and a pressure are selected to provide a greater thickness of the conductive material layer at an upper portion of the interconnected opening compared to a lower portion thereof; increasing the bias power and the pressure; and continuing the formation of the conductive material layer to predominately deposit the conductive material layer at the lower portion.

6. Wang discloses a two-step method for filling copper into a high aspect ratio hole (abstract). The method comprises depositing a layer in two separate biasing states with the first biasing state being 85V or less and then at a bias of 150-200V [0054]. The pressure is raised from the beginning of sputtering to the end of the second step [0075].

7. For claim 2, Applicant requires the bias voltage and pressure in first state to be selected to obtain a thickness of the first layer that is greater at an upper portion of the opening as compared to a bottom of the opening. For claim 3, Applicant requires the bias and pressure of the second state to be selected to that the thickness of the layer is greater at a bottom of the

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opening as compared to a top portion. The biasing results in a low biasing state of more deposition at the top of the hole (Figure 7) and then a high biasing of more deposition in the bottom than the top (Figure 8).

8. For claim 4, Applicant requires the pressure in the first state to be approximately 1-5 millitorr. A pressure of about 0.5 millitorr [0051] is used when a 200 mm chamber is used. A pressure of 0.5 mTorr is approximately 1 mTorr.

9. For claim 5, Applicant requires the power to be approximately 0-300 watts in the first state. A bias of 0-50 W is used for the low bias [0053].

10. For claims 6 and 18, Applicant requires the second state pressure to be higher than approximately 8 milliTorr. The pressure of 0.5 mTorr is considered to be “approximately” 8mTorr.

11. For claims 7 and 19, Applicant requires the bias power for the second state to be approximately 400 W or higher. A wattage of 800-1000W is used for the second bias [0053].

12. For claims 8, 9, and 20, the layers are tantalum, tantalum nitride, titanium, or titanium nitride. The layers deposited can be tantalum and tantalum nitride [0042].

13. For claims 10 and 21, Applicant requires the material composition of the deposition atmosphere to differ from that in the second state. When the Ta/TaN bi-layer is deposited, the limitation is met.

14. For claims 11 and 22, Applicant requires the material composition of the deposition to be substantially the same in the first and second state. When copper is deposited, the limitation is met.

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15. For claims 12, 13, and 23, Applicant requires supplying a precursor gas to the atmosphere during at least one of the first and second states. Hydrogen can be supplied when sputtering [0087] as a precursor gas.

16. Claims 1, 6-14, and 16 are rejected under 35 U.S.C. 102(e) as being anticipated by US 2003/0209422 A1 to Wang et al. (Wang II).

17. Claims 1 and 6-13 are described above. For claim 14, Applicant requires a method of controlling a deposition rate in an ionized sputter deposition process comprising a sequence including providing a substrate having formed therein at least one via; establishing a deposition atmosphere around the substrate with a specified pressure and a specified bias power for directing target ions towards the substrate; determining a thickness of a deposited layer at the upper portion and the lower portion of the opening; and increasing at least one of the bias and pressure when an absolute amount of a difference of the thickness at the lower portion of the upper portion is less than a predefined threshold. For claim 16, Applicant requires at least one of tantalum, tantalum nitride, titanium, and titanium nitride to be used.

18. Wang II discloses a method for depositing a film on a substrate (abstract) comprising applying a DC power to a target at a certain pressure to deposit a layer and then applying a second pressure and a RF power to the target to deposit a second layer (Figure 2). The power for the first deposition is 20-24 kW [0026] and the pressure of less than 2mTorr [0026]. The power for the second deposition is 0 W DC and 1-10 kW RF power [0029] at a pressure of 10-100 mTorr [0028]. The layer formed is tantalum [0015]. A precursor gas of argon is used (Claim 12) and the composition of the first state is either the same when two-tantalum nitride layer are

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deposited [0042] or different from the second state where tantalum is deposited on tantalum nitride [0043].

19. Claims 1, 6, 8, 9, 11, 13, 14, and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by US 6,380,058 B2 to Manabe et al. (Manabe).

20. Claims 1, 6, 8, 9, 11, 13, 14, and 16 are described above. Manabe discloses forming a barrier layer in a via (abstract) by forming a first film by sputtering at a first pressure and forming a second film at a second pressure higher than the first pressure (col. 3, l. 35-42). The first pressure is 0.5 mTorr (col. 7, l. 38-39) to deposit a titanium nitride layer (col. 7, l. 56-58). The second layer is also titanium nitride (col. 8, l. 2-5) and is deposited at a pressure of at least 2 mTorr (claim 5). A precursor gas is flowed into the system (First example).

21. Claims 1, 6, 7, 11, and 14 are rejected under 35 U.S.C. 102(b) as being anticipated by US 5,108,570 to Wang (Wang III).

22. Claims 1, 6, 7, 11, and 14 are described above. Wang III discloses a multistep aluminum sputtering process whereby trenches are filled (abstract). The process involves a first deposition step that is conducted until the thickness is measured to be 200-2000 Angstroms thick (col. 7, l. 25-28). The deposition occurs at a pressure of about 1-8 mTorr and a power supply of about 1-16 kW (col. 6, l. 30-41). The second deposition step occurs at a power level of about 20 kW (col. 7, l. 36-39).

Allowable Subject Matter

23. Claim 15 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

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24. The following is a statement of reasons for the indication of allowable subject matter: it is neither anticipated nor obvious over the prior art of record to have a method of controlling a deposition rate in an ionized sputter deposition process as claimed by Applicant in claim 15 wherein the sequence is repeated.

25. Wang II, Wand III, and Manabe do not indicate that the sequence of deposition conditions can be repeated.

General Information

For general status inquiries on applications not having received a first action on the merits, please contact the Technology Center 1700 receptionist at (571) 272-1700.

For inquiries involving Recovery of lost papers & cases, sending out missing papers, resetting shortened statutory periods, or for restarting the shortened statutory period for response, please contact Denis Boyd at (571) 272-0992.

For general inquiries such as fees, hours of operation, and employee location, please contact the Technology Center 1700 receptionist at (571) 272-1300.


Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven H VerSteeg whose telephone number is (571) 272-1348. The examiner can normally be reached on Mon - Thurs (6:30 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Steven H VerSteeg
Primary Examiner
Art Unit 1753

shv
March 28, 2005